Course Title: **Radiological Control Technician**
Module Title: **Shipment/Receipt of Radioactive Material**
Module Number: **2.12**

Objectives:

	2.12.01	List the applicable agencies which have regulations that govern the transport of radioactive material.
	2.12.02	Define terms used in DOT regulations.
	2.12.03	Describe methods that may be used to determine the radionuclide contents of a package.
	2.12.04	Describe the necessary radiation and contamination surveys to be performed on packages and state the applicable limits.
	2.12.05	Describe the necessary radiation and contamination surveys to be performed on exclusive use vehicles and state the applicable limits.
	2.12.06	Identify the proper placement of placards on a transport vehicle.
⇒	2.12.07	Identify inspection criteria that should be checked prior to releasing a shipment at your site.
⇒	2.12.08	Describe site procedures for receipt and shipment of radioactive material shipments.
⇒	2.12.09	List the actions required at your site if a shipment is received exceeding radiation or contamination limits.
⇒	2.12.10	Describe the proper step-by-step method for opening a package containing radioactive material at your site.

REFERENCES

1. 10 CFR 835 (1998), “Occupational Radiation Protection”
2. 49 CFR, Parts 100-177, “Transportation”

RADIOACTIVE MATERIAL SHIPMENT REGULATIONS

The basis behind the regulations governing the packaging and shipping of radioactive material is to keep radiation and radioactive material from affecting the environment during transportation and to keep the environment from affecting the integrity of the radioactive material.

The package itself is to be designed and constructed to be the effective barrier between the environment and the radioactive material, thus most of the regulatory restrictions apply to the package and the method of shipment used to transport the package.

To reduce any potential hazard, the regulatory requirements become more restrictive as the quantity, concentration, and potential hazard of the radioactive material increases.

2.12.01 List the applicable agencies which have regulations that govern the transport of radioactive material.

Regulatory Structure. Numerous governmental agencies have jurisdiction over the transfer and shipment of radioactive material from nuclear facilities. The primary organizations are:

- U.S. Department of Energy
- U.S. Nuclear Regulatory Commission
- U.S. Department of Transportation, Hazardous Material Bureau
- U.S. Coast Guard
- International Civil Aviation Organization or International Air Transport Association
- State transportation departments or radiation health bureaus.

U.S. Department of Energy. The U.S. DOE establishes regulations to protect the public health and safety from undue risk from DOE activities. These regulations are in the form of 10 CFR 835 and DOE Orders. DOE requirements applicable to packaging and transportation of radioactive material include:

- 10 CFR 835 – The Exclusion section of 10 CFR 835.1 states that occupational doses received as a result of excluded activities and radioactive material transportation shall be considered when determining compliance with the occupational dose limits in §§835.202 and 835.207.

- DOE O 460.1-1 – Establishes administrative procedures for the certification and use of radioactive and other hazardous materials packaging by DOE. Establishes standards and requirements for the packaging and transportation of hazardous (including radioactive) materials, substances and wastes. This Order requires that packages for radioactive materials meet the NRC standards in 10 CFR 71 and imposes additional restrictions.

- DOE Order 460. – Establishes DOE policies and procedures for the management of materials transportation activities, including traffic management, for other than intrabuilding and intrasite transfers. It contains general requirements related to all transportation activities, not just hazardous or radioactive materials.

- DOE Order 5480.4 – Lists laws, regulations, and standards issued by organizations other than DOE that are either required or recommended to be followed in conducting DOE operations. This Order lists the following standards related to shipment of radioactive materials:

  - Mandatory as a Result of Federal Statutes – 49 CFR 170-179, DOT Hazardous Materials Regulations 10 CFR 71, NRC Regulations on Packaging of Radioactive Materials for Transport

  - Mandatory as a Matter of DOE Policy – International Atomic Energy Agency Safety Series No. 6, Regulations for the Safe Transport of Radioactive Material International Air Transport Association Restricted Article Regulations

The Order also lists several publications from Oak Ridge National Laboratory, the American National Standards Institute, and Nuclear Regulatory Commission Regulatory Guides as non-mandatory References on Good Practice.

- DOE Order 5820.2A – Establishes policies, guidelines, and minimum requirements by which DOE manages its radioactive wastes.

U.S. Department of Transportation. The U.S. DOT regulates transportation by air, water, rail, and highway. The Materials Transportation Bureau has established rules governing the packaging and transport of hazardous material, including radioactive material.

These regulations are contained in 49 CFR 170 - 179 and are applicable to any person who transports, or ships, a hazardous material. Even though most of the requirements for shipping radioactive material are located in Part 173, the other sections of DOT regulations must not be overlooked.

Regulatory Compliance. There are many regulations and documents from several agencies that govern the transfer and transport of radioactive material. Compliance with all regulations, not just those from one agency, is required to transfer and shipment of radioactive material. The number of regulations involved depends upon the chosen mode of transport and the quantity of radioactive material. Each individual or group assigned the responsibility of transferring and shipping radioactive material must maintain a complete set of current regulations from all applicable agencies as well as other supporting regulatory guides, licenses and clarifying documents.

Keep in mind that most regulations usually contain exemptions and may contain more restrictive clauses. For example, the DOT may exempt some shipments of low quantities

and types of radioactive material from their regulations. The DOT exemption, however, does not automatically exempt the material from DOE requirements. It is best to be aware of the requirements from all agencies to avoid citations for using one specific exemption that is not recognized by the other agencies.

2.12.02 Define terms used in DOT regulations.

DEFINITION OF TERMS

In order to understand the regulations, it is necessary to understand the basic language and limits established in the regulations. The following definitions are found in 49 CFR 173.403 (this is not a complete listing of the §173.403 definitions):

A_1. The maximum activity of special form radioactive material permitted in a Type A package.

A_2. The maximum activity of radioactive material, other than special form, Low Specific Activity, or Surface Contaminated Object, permitted in a Type A package.

Radioactive Material. Any material having a specific activity greater than 70 Bq per gram (0.002 microcurie per gram). No other U.S. Department or Agency uses this limit.

Exclusive Use (also referred to as "sole use" of "full load"). Sole use by a single consignor of a conveyance for which all intial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or the consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consigment. The consignor must issue specific instructions in writing, for maintenance of exclusive use shipment controls, and include them with the shipping paper information provided to the carrier by the consignor.

Limited Quantity. A quantity of radioactive material not exceeding the materials packaging limits specified in §173.425 and conforming with requirements specified in §173.421.

Low Specific Activity (LSA). Radioactive material with limited specific activity which satisfies the descriptions and limits set forth below. Shielding materials surrounding LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of three groups:

1) LSA-I

   i) Ores containing only naturally occurring radionuclides (e.g., uranium, thorium) and uranium or thorium concentrates of ores; or

ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or

iii) Radioactive material, other than fissile material, for which the A_2 value is unlimited; or

iv) Mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which the radioactive material is essentially uniformly distributed and the average specific activity does not exceed $10^{-6}A_2/g$.

2) LSA-II

i) Water with tritium concentration up to 0.8 Tbq/liter (20 Ci/liter); or

ii) Material in which the radioactive material is distributed throughout and the average specific activity does not exceed $10^{-4}A_2/g$ for solids and gases, and $10^{-5}A_2/g$ for liquids.

3) LSA-III: Solids (e.g., consolidated wastes, activated materials) that meet the requirements of §173.468 and which:

i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumin, ceramic, etc.); and

ii) The radioactive material is relatively insoluble, or it is intrinsically contained in an insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed 0.1 A_2; and

iii) The average specific activity of the solid does not exceed $2x10^{-3}A_2/g$.

Normal Form. Radioactive material which has not been demonstrated to qualify as Special Form radioactive material. In other words, this includes most radioactive material shipped, except encapsulated sources with the "Special Form" certification.

Package. The packaging together with its radioactive contents as presented for transport.

1) Excepted Package means a packaging together with its excepted radioactive materials as specified in §§173.421-173.426 and 173.428.

2) Type A Package means a packaging that, together with its radioactive contents limited to A_1 or A_2 as appropriate, meets the requirements of §§173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by Part 173 under normal conditions of transport as demonstrated by the tests set forth in §173.465 or §173.466, as appropriate.

3) Type B Package means a packaging that, together with its radioactive contents, is designed to retain the integrity of containment and shielding required by Part 173 when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10 CFR 71. There are specific Type B packages, which include Type B(U) and Type B(M) packages. Their requirements are specified in §173.403.

4) Industrial Packaging means a packagin that, together with its Low Specific Activity material or Surface Contaminated Object contents, meets the requirements of §§173.410 and 173.411. Industrial Packaging is further categorized in §173.411 as Type 1, Type 2, or Type 3.

Packaging. The assembly of components necessary to ensure compliance with the packaging requirements of Part 173, Subpart I. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, service equipment for filling, emptying, venting and pressure relief, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

Special Form. Radioactive material which satisfies the following conditions:

1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

2) The piece or capsule has at least one dimension not less than 5 millimeters (0.2 inch); and

3) It satisfies the test requirements of §173.469. There are other specific special form encapsulation design exceptions found elsewhere in Part 173.

Surface Contaminated Object (SCO). A solid object which is not itself radioactive but which has radioactive material distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limits:

1) SCO-I: A solid object on which:

   i) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 (10^{-4} microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or 0.4 Bq/cm^2 (10^{-5} microcurie/cm^2) for all other alpha emitters;

   ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4x10^4$ Bq/cm^2 (1.0 microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Bq/cm^2 (0.1 microcurie/cm^2) for all other alpha emitters; and

iii) The non-fixed contamination plus the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4x10^4$ Bq/cm^2 (1.0 microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or $4x10^3$ Bq/cm^2 (0.1 microcurie/cm^2) for all other alpha emitters.

2) SCO-II: A solid object on which the limits for SCO-I are exceeded and on which:

i) The non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 (10^{-2} microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or 40 Bq/cm^2 (10^{-3} microcurie/cm^2) for all other alpha emitters;

ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8x10^5$ Bq/cm^2 (20 microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/cm^2 (2 microcurie/cm^2) for all other alpha emitters; and

iii) The non-fixed contamination plus the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $8x10^5$ Bq/cm^2 (20 microcurie/cm^2) for beta and gamma and low toxicity alpha emitters, or $8x10^4$ Bq/cm^2 (2 microcurie/cm^2) for all other alpha emitters.

Transport Index. The dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation.

Type A Quantity. A quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material.

Type B Quantity. A quantity of radioactive material greater than a Type A quantity.

APPLICATION OF REGULATORY REQUIREMENTS

The following is a general discussion of the steps followed to:

- Determine the type and quantity
- Determine the activity and radiation levels
- Package
- Mark, label, and placard
- Surveys of packages and transport vehicles

- Prepare shipping papers.

These steps are for a typical shipment of radioactive material. This discussion is not all inclusive of every regulatory requirement and is intended only as an explanation of the major transportation considerations.

Each individual responsible for transfer, packaging or shipping should become familiar with the regulations and other regulatory documents and establish clear, step-by-step instructions in the form of procedures for workers to follow.

If the radioactive material is in a physical or chemical form that constitutes a hazard in addition to the radiological hazard (such as an acid, base, toxic or flammable substance), additional regulations could apply to the packaging, shipment and disposal of the material. This type of waste is known as "Mixed Hazardous Waste." Additional requirements for Mixed Waste are specified in DOT, EPA, and state regulations.

2.12.03 Describe methods that may be used to determine the radionuclide contents of a package.

Radioactive Contents. In order to determine packaging, labeling and other requirements for shipping radioactive material, the radionuclide content of the material must be known. This includes the identity and quantity of each isotope.

Identification and quantitative measurement of most gamma emitting isotopes is fairly simple using gamma energy spectroscopy techniques. It is much more difficult to identify and measure beta and alpha emitting radionuclides. Recognizing these problems, the NRC issued technical papers and other guidance on radionuclide identification techniques. The NRC position papers state that there are four basic methods which are considered acceptable for radionuclide identification. These methods are materials accountability, classification by source, gross radioactivity measurements, and direct measurement of individual radionuclides.

The materials accountability technique is primarily applicable to wastes and involves determining the quantity of radioactive material contained within a volume by comparing the amount of radioactive material entering and exiting a given process. For example, if the concentration of airborne radioactivity entering and leaving a HEPA filter is measured and the air volume passing through the filter is known, the difference can be assumed to be retained in the filter.

The classification by source method involves determining the radionuclide content through knowledge and control of the source of the material. For example, a sealed calibration source that was leaking and had to be returned to the manufacturer could be assumed to contain the same isotope and quantity of radioactive material as when it was received, provided that source control and inventory procedures are adequate to ensure traceability of the material (i.e., to prove that the sealed source being shipped is the same one that was received).

Measurement of gross radioactivity (e.g., based on a dose rate from a container) is an acceptable method for radionuclide identification provided that:

- The gross radioactivity measurements are correlated to the actual radionuclides in the material.

- The gross measurement is initially correlated to actual radionuclide content and periodically verified.

The final acceptable method for determining radionuclide content is by direct measurement. In this method, individual gamma emitting radionuclides are directly measured using gamma spectroscopy. Concentrations of other radionuclides are projected by determining their ratio to the concentration of gamma emitting radioisotopes. The ratios are usually referred to as scaling factors. This method is essentially the same as the gross measurement method except for the quantitative measurement of the individual gamma emitting isotopes.

2.12.04 Describe the necessary radiation and contamination surveys to be performed on packages and state the applicable limits.

Package Radiation Surveys and Limits

Except as provided in paragraph (b) of §173.441, each package of radioactive materials offered for transportation must be designed and prepared for shipment, so that under conditions normally incident to transportation, the radiation level does not exceed 2 mSv/hour (200 mrem/hour) at any point on the external surface of the package, and the transport index does not exceed 10.

A package which exceeds 2 mSv/hour (200 mrem/hour) or a transport index of 10 must be transported by exclusive use shipment, and the radiation levels for such shipment may not exceed the following during transportation:

1) 2 mSv/h (200 mrem/h) on the external surface of the package unless the following conditions are met, in which case the limit is 10 mSv/h (1000 mrem/h):

   i) The shipment is made in a closed transport vehicle;

   ii) The package is secured within the vehicle so that its position remains fixed during transportation; and

   iii) There are no loading or unloading operations between the beginning and end of the transportation;

2) 2 mSv/h (200 mrem/h) at any point on the outer surfaces of the vehicle, including the top and underside of the vehicle; or in the case of a flat-bed style vehicle, at any point

on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load or enclosure if used, and on the lower external surface of the vehicle;

3) 0.1 mSv/h (10 mrem/h) at any point 2 meters (6.6 feet) from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle); or in the case of a flat-bed style vehicle, at any point 2 meters (6.6 feet) from the vertical planes projected by the outer edges of the vehicle (excluding the top and underside of the vehicle); and

4) 0.02 mSv/h (2mrem/h) in any normally occupied space, except that this provision does not apply to carriers if they operate under the provisions of a State or federally regulated radiation protection program and if personnel under their control who are in such an occupied space wear radiation dosimetry devices.

For shipments made under the exclusive use provisions, the offeror shall provide specific written instructions for maintenance of the exclusive use shipment controls to the carrier. The instructions must be included with the shipping paper information. The instructions must be sufficient so that, when followed, they will cause the carrier to avoid actions that will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures to transport workers or members of the general public.

Packages exceeding 2 mSv/hour (200 mrem/hour) or a transport index of 10 may not be transported by aircraft.

Contamination Surveys and Limits (Off-site shipments via non-DOE conveyance)

The level of non-fixed (removable) radioactive contamination on the external surfaces of each package offered for transport must be kept as low as reasonably achievable. The level of non-fixed radioactive contamination may not exceed the limits set forth in Table 11 of §173.443 and must be determined by either:

1) Wiping an area of 300 square centimeters of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the non-fixed contamination levels. The amount of radioactivity measured on any single wiping material, when averaged over the surface wiped, may not exceed the limits set forth in Table 11 of §173.443 at any time during transport; or

2) Using other methods of assessment of equal or greater efficiency, in which case the efficiency of the method used must be taken into account and the non-fixed contamination on the external surfaces of the package may not exceed ten times the limits set forth in Table 11 of §173.443, as follows:

2.12.05	*Describe the necessary radiation and contamination surveys to be performed on exclusive use vehicles and state the applicable limits.*

Table 1 - DOT Contamination Limits (Table 11 of §173.443)

Contaminant	**Maximum Permissible Limits**		
	Bq/cm ^{2}	**μCi/cm^2**	**dpm/cm^2**
Beta and gamma emitters and low toxicity alpha emitters	0.4	10^{-5}	22
All other alpha emitting radionuclides	.04	10^{-6}	2.2

§173.428 states that a packaging which previously contained radioactive materials and has been emptied of contents as far as practical, is excepted from the shipping paper and certification, marking and labeling requirements of this Part 173, provided that

a) The packaging meets the requirements of Sec. 173.421(a) (2), (3), and (5) of this §173 Subpart I;

b) The packaging is in unimpaired condition and is securely closed so that there will be no leakage of radioactive material under conditions normally incident to transportation;

c) Internal contamination does not exceed 100 times the limits in §173.443(a);

d) Any labels previously applied in conformance with Subpart E of §172 are removed, obliterated, or covered and the ``Empty'' label prescribed in §172.450 is affixed to the packaging; and

e) The packaging is prepared for shipment as specified in §173.422.

Contamination Surveys and Limits (On-site and off-site shipments by DOE conveyance) 49 CFR 172 through 173 describe requirements for inspecting and surveying packages, containers and transport conveyances prior to off-site transport. The 49 CFR 173 contamination values shall be used as controlling limits for off-site shipments transported by DOE and non-DOE conveyances. These limits also apply to on-site transfers of shipments by non-DOE conveyances received from or destined to off-site locations.

On-site shipments by DOE conveyances may use alternative DOE limits for contamination, radiation, packaging, etc., provided the alternative is approved.

DOE Radiological Control Standard, Table 2-2, contamination values may be used as controlling limits for on-site and off-site transportation when using a DOE conveyance. When a shipment is received from an off-site destination, in or on a non-DOE conveyance, the 49 CFR contamination values shall be used when transfers are made in a DOE conveyance from the on-site receiving location to the ultimate on-site destination.

Package Marking, Sealing and Labeling.

§173.427 states that for LSA material and SCO required to be consigned as exclusive use for domestic transportation only, packages are excepted from the marking and labeling requirements of this subchapter. However, the exterior of each nonbulk package must be stenciled or otherwise marked ``Radioactive--LSA" or ``Radioactive--SCO", as appropriate, and nonbulk packages that contain a hazardous substance must also be stenciled or otherwise marked with the letters ``RQ" in association with the above description.

Except as provided above, LSA material and SCO must be packaged as follows:

1) In an industrial package;

2) For domestic transportation only, in a Type A package. The requirements of §173.412 (a), (b), (c) and (k) do not apply;

3) For domestic transportation only, in a strong, tight package that prevents leakage of the radioactive content under normal conditions of transport. In addition to the requirements of paragraph (a) of §173.427, the following requirements must be met:

    i) The shipment must be exclusive use;

    ii) The quantity of radioactive material in each packaging may not exceed an A_2 quantity;

4) For domestic transportation only, in a packaging that complies with the provisions of 10 CFR 71.52, and is transported in exclusive use; or

5) Any Type B, B(U) or B(M) packaging authorized pursuant to §173.416.

Type A Packages

In addition to meeting the general design requirements prescribed in §173.410, each Type A packaging must be designed so that–

a) The outside of the packaging incorporates a feature, such as a seal, that is not readily breakable, and that, while intact, is evidence that the package has not been opened. In the case of packages shipped in closed transport vehicles in exclusive use, the cargo compartment, instead of the individual packages, may be sealed.

b) The smallest external dimension of the package is not less than 10 centimeters (4 inches).

Type B Packages.

Type B package labeling and marking must meet the following requirements:

a. Follow the same requirements as those described for Type A packages.

b. Follow any additional sealing, labeling, and marking requirements contained in the NRC Certificate of Compliance for the package or site transport plan.

Surveys of Transport Vehicle. Radiation and contamination surveys should be performed when an Exclusive Use transport vehicle arrives at the site to ensure that the vehicle is not exceeding applicable DOT limits. If found to be above these limits, the vehicle should not be loaded until properly decontaminated and the owner of the transport vehicle and the site packaging and transportation department informed. During loading, exclusive use transport vehicles should be frequently surveyed to avoid the problem of rearranging the load after it is discovered that the radiation levels are above limits.

Vehicle Radiation Surveys. Radiation surveys should be performed at the appropriate locations to ensure that the radiation level limits are not exceeded.

Outgoing Vehicle Contamination Surveys. DOT regulations do not specify contamination limits for transport vehicles other than those designated exclusive use. It is assumed that if packages loaded onto vehicles are kept within their contamination limits, the vehicle will be within the package contamination limits. Contamination surveys of the packages should be conducted at the time of loading to ensure that they have not become contaminated in storage or through handling.

Even though DOT regulations do not specifically require contamination surveys for non-exclusive use vehicles, it is good radiological control practice to perform such surveys to ensure that no contamination is spread to off site areas. Prior to releasing a radioactive material shipment vehicle, survey the bed of the truck, floor, seat, and door handles of the cab, controls in cab, tires, and other areas which could have become contaminated during loading.

2.12.06 Identify the proper placement of placards on a transport vehicle.

Proper Placarding of Transport Vehicle..

Do not over-label or placard a vehicle unnecessarily. Application of such placard when the hazard does not exist is a violation of regulations.

Description of Placard. The radioactive placard is diamond shaped with "Radioactive" in black centered across it on a white background. The upper portion of the sign has a black radiation symbol on a yellow background (49 CFR 172.556). The placard must be fastened to all four sides of the vehicle (49 CFR 172.504(a)).

Location of Placards on Transport Vehicle. Placards must be on all four sides of the vehicle. If a tractor is disconnected from the trailer, placards must be on all four sides of the trailer otherwise the front placard can be on the tractor. After the shipment has been officially received on the receivers property, it is usually posted in accordance with regular posting (Radiation Area, High Radiation Area, Contamination Area, etc.)

2.12.07	*Identify inspection criteria that should be checked prior to releasing a shipment at your site.*

Inspection Prior to Release of Shipment

(Insert site specific information here)

Documentation. For all shipments, the shipping papers must adhere to the requirements of 49 CFR 172.200 through 172.204.

Verification of Receiving Facility's Authorization to Receive the Material. 10 CFR 30.41 and 10 CFR 70.42 require that before transferring byproduct and/or special nuclear material, respectively, the shipper must verify that the receiving facility has a license that authorizes the receipt of the material being shipped.

Although these restrictions only apply to NRC licensees, it is good practice to perform the same verification prior to shipping radioactive material to other DOE facilities. Some DOE facilities that normally use only a few isotopes may not have the proper training or instruments to safely receive and control the material. It must also not be assumed that other government agencies are exempt from NRC regulations and license restrictions. Most Department of Defense facilities that use radioactive materials, for example, are licensed by the NRC.

VIOLATIONS OF REGULATIONS

Increased public awareness of issues concerning the nuclear industry including the associated activities of shipping radioactive material and disposing of radioactive waste, has led to increased political activity in creating new laws, regulations, and acceptance criteria along with increased inspection activities. Violations of regulations are considered "serious." Many personnel within the nuclear industry who are not aware of all of the regulatory requirements are putting themselves, and others, at risk. Ignorance of the requirements and lack of attention to detail has lead to many violations. Keeping

current with the latest requirements, periodically reviewing all requirements, creating and enforcing current procedures to clarify methods of compliance, and inspecting shipments before they leave the facility is no longer a part time job. Personnel assigned the responsibility of packaging and shipping radioactive material must realize the seriousness and consequences of even a minor infraction of the regulations.

Frequent violations of DOT regulations include:

- Leaking packages
- Contaminated packages and vehicles
- Radiation levels exceeding limits in vehicle cabs, underneath vehicles, and other limits
- Load not securely fastened•Mechanical deficiencies in the vehicles
- Instructions not provided to carrier for maintaining "exclusive use" of vehicle
- Improper package closure
- Improper packagings for the type or quantity of radioactive material
- Improper or missing markings, labels or placards
- Incomplete and incorrect information on shipping papers.

2.12.08	*Describe site procedures for receipt and shipment of radioactive material shipments.*

RECEIPT OF RADIOACTIVE MATERIAL

10 CFR 835 requires the following:

§835.405 Receipt of radioactive packages.

(a) If packages containing quantities of radioactive material in excess of a Type A quantity (as defined in 10 CFR 71.4) are expected to be received from radioactive material transportation, arrangements shall be made to either:

(1) Take possession of the package when the carrier offers it for delivery; or

(2) Receive notification as soon as practicable after arrival of the package at the carrier's terminal and to take possession of the package expeditiously after receiving such notification.

(b) Upon receipt from radioactive material transportation, external surfaces of packages known to contain radioactive material shall be monitored if the package:

(1) Is labeled with a Radioactive White I, Yellow II, or Yellow III label (as specified in 49 CFR 172.403 and 172.436-440); or

(2) Has been transported as low specific activity material on an exclusive use vehicle (as these terms are defined in 10 CFR 71.4); or

(3) Has evidence of degradation, such as packages that are crushed, wet, or damaged.

(c) The monitoring required by paragraph (b) shall include:

(1) Measurements of removable contamination levels, unless the package contains only special form (as defined at 10 CFR 71.4) or gaseous radioactive material; and

(2) Measurements of the radiation levels, unless the package contains less than a Type A quantity (as defined in 10 CFR 71.4) of radioactive material.

(d) The monitoring required by paragraph (b) of this section shall be completed as soon as practicable following receipt of the package, but not later than 8 hours after the beginning of the working day following receipt of the package.

It is necessary that packages of radioactive material be expeditiously delivered and that the existence of a leak be rapidly detected to minimize radiation exposure to transportation and plant personnel, to minimize the spread of contamination and to aid in identifying personnel and property that may have been exposed or contaminated during the transport of the radioactive material. Prompt and careful inspection of packages containing radioactive material is required by DOE O 460.2. If the inspection results in even the suspicion that the package may have been damaged in transit, surveys for removable contamination are required.

(Insert site specific information here)

SHIPMENT OF RADIOACTIVE MATERIAL

(Insert site specific information here)

2.12.09	*List the actions required at your site if a shipment is received exceeding radiation or contamination limits.*

SHIPMENT EXCEEDING LIMITS

Action When Limits Are Exceeded. If it is known, assumed, or suspected that the delivering vehicle or packages are contaminated, the delivering carrier, all intermediate carriers and the shipper must be notified immediately so that potentially contaminated vehicles can be withdrawn from service and checked. Loading docks and terminals through which the package passed in transit must also be surveyed. If any contamination is found on package surfaces, it is important to check any areas, equipment or personnel who may have become contaminated handling the package. Depending on the extent of contamination, the incident may also require notification to DOE Headquarters under the Unusual Occurrence Reporting system and could result in activation of the Radiological Assistance Plan. If a package was received from an NRC licensee, the director of the NRC Inspection and Enforcement Regional Office should also be notified.

(Insert site specific information here)

2.12.10	*Describe the proper step-by-step method for opening a package containing radioactive material at your site.*

OPENING PACKAGES OF RADIOACTIVE MATERIAL

It is good radiological control practice to establish, maintain, and follow procedures for opening packages containing radioactive material.

(Insert site specific information here)

SUMMARY

Radioactive material which is to be transported from one location to another must be properly packaged, surveyed, labeled and documented. Currently there are approximately 50,000 weekly shipments of radioactive material in the U.S. Strict adherence to shipping requirements is requisite to maintain high levels of safety.

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